

# Foreign Body Aspiration

Potentially life-threatening emergency due to impending airway obstruction requiring diagnosis of emergency vs. non-emergency situation and appropriate treatment.

## ANESTHETIC CONSIDERATIONS:

- **Potentially** life-threatening emergency due to impending airway obstruction
- Shared airway
- Considerations of emergency case – full stomach precautions, little time for optimization
- Physiologic & anatomic concerns of the pediatric patient (pediatric >> adult)
- Co-morbid factors predisposing to FB aspiration (e.g. neurologic disease / intoxication)
- Considerations of rigid bronchoscopy
  - Shared airway
  - Options for periprocedural oxygenation and ventilation
    - Intermittent jet ventilation via bronch/ intermittent PPV
    - Maintain spontaneous ventilation
  - Maintenance of quiet surgical field balanced with spontaneous ventilation
  - Possibility of airway/dental/oral trauma
  - Possibility of airway perforation
  - Maintenance of anesthesia – TIVA vs volatile

## ANESTHETIC GOALS:

- Prevent airway obstruction
  - Avoid PPV and maintain spontaneous ventilation
  - Avoid agitation
- Minimize distal displacement of FB
- Minimize ball-valve obstruction
- Provide quiet surgical field
- Effective communication between surgeon & anesthesiologist

## HISTORY

- Goal is to establish:
  - The degree of airway obstruction
  - The details of the foreign body (organic [can swell, inflammatory response] vs. sharp [can perforate])
  - Factors predisposing to aspiration
  - Timing of aspiration - 2 Groups:
    - Acute presentation
      - Witnessed aspiration
      - Sudden onset choking, with intractable coughing and vomiting
      - Stridor, respiratory distress, cough, hemoptysis, dysphagia
      - Tracheal foreign bodies may present with a brassy cough, bidirectional stridor with or without voice changes
    - Delayed presentation
      - Un-witnessed
      - Unexplained cough, dysphagia, wheezing, secondary infection distal to obstruction, fever
      - Consider presence of pneumonia in delayed presentation

## PHYSICAL

- **GENERAL** – Vitals including temperature (consider infection in delayed presentation)
- **HEENT** – Airway exam for ease of intubation
- **RESP**
  - Evidence of acute upper airway obstruction or impending airway obstruction
  - Tachypnea; stridor; tracheal tugging or shift; accessory muscle use; cyanosis; decreased LOC; fever, aphonia / hoarseness, drooling
  - Examine for evidence of air trapping / hyperinflation (ball-valve effect) or atelectasis
  - Auscultate for symmetry of breath sounds and presence of wheeze
- **CVS** - Focused cardiac examination including volume status

## INVESTIGATIONS

- Depends on urgency of situation
- **Labs**
  - CBC (if pneumonia)
  - ABG – severity, hypoxia / hypercarbia (if patient is moribund)
- **Imaging**
  - CXR: inspiratory / expiratory view can demonstrate:
    - Hyperinflation with proximal obstruction
    - Atelectasis with distal obstruction, pneumonia
    - 90% of aspirated objects are radiopaque
- **Special**
  - Consults: ENT, thoracic surgery, others as indicated

## OPTIMIZATION

- Supplemental oxygen as required

- EMLA for IV access – agitation may precipitate airway obstruction and/or distal migration of FB
- Position:
  - Upper airway: position of comfort / sitting upright – leaning forward
  - Distal airway: affected lung down, to protect normal lung
- Aspiration prophylaxis
- Consider antisialagogue (e.g. glycopyrrolate)
- Bronchodilators, racemic epinephrine (may decrease surrounding edema & improve airflow in partial obstruction), Heliox
- Consider IV dexamethasone
- Somewhat controversial whether to delay stable patients (e.g. blunt object, without evidence of significant obstruction) to satisfy fasting guidelines – discuss with surgeon
- Antibiotics if signs of infection (as indicated)

#### ANESTHETIC OPTIONS

- **Pediatric** - GA with spontaneous ventilation
- **Adult** – sedation / topicalization for flexible bronchoscopy vs. GA with spontaneous ventilation for rigid bronchoscopy
- **Spontaneous vs. controlled** ventilation
  - Maintenance of spontaneous ventilation is the traditional, conservative approach to minimize
    - Ball-valve phenomenon
    - Distal displacement of the foreign body
    - Interruption of ventilation while bronchoscopist performing extraction
  - **Disadvantages** to spontaneous ventilation include inferior oxygenation, patient movement & atmospheric pollution

#### POTENTIAL CONFLICTS

- Full stomach and risk of aspiration with spontaneously breathing technique
- Increased ICP or pulmonary hypertension (risk of hypercapnia and hypoxemia with spontaneously breathing technique)
- Malignant hyperthermia (necessitates TIVA)
- Congenital heart disease
- Anticipated difficult airway

#### ANESTHETIC SETUP

- **Drugs**
  - Emergency drugs
- **Equipment**
  - Standard CAS
  - Variety of ETTs & difficult airway cart with FOB
  - Cricothyroidotomy or tracheostomy set
  - Rigid bronchoscopy equipment (most effective ~ 98% success) and surgeon in room
  - Second anesthetist or RT

#### MANAGEMENT OF ANESTHESIA

- **Induction**
  - Metoclopramide / Ranitidine / Citrate for full stomach patients
  - Provide supplemental O<sub>2</sub>
  - Antisialagogue:
    - Glycopyrrolate is generally useful
  - Airway Exam:
    - Like microlaryngoscopy, some authors recommend that if there is any question about the airway, direct laryngoscopic examination should be performed in an awake, topicalized patient to assess the difficulty of intubation (adults)
  - Volatile (sevoflurane) vs. TIVA induction may be used for the spontaneously breathing patient
    - Volatile induction with cricoid is accepted practice
  - Carefully consider if muscle relaxants are indicated – usually in conflict with spontaneous ventilation
  - Topicalize / block once deep
  - Inspect supraglottic area for FB while securing airway
- **Maintenance**
  - TIVA vs. volatile
    - Appreciate rapid emergence owing to Sevoflurane insolubility may only permit short disconnection from anesthetic circuit
    - TIVA uncouples delivery of anesthetic from ventilation
  - Small amounts of PEEP may be helpful for any degree of obstruction (be wary of pushing FB deeper)
  - Permissive hypercapnia and keep SpO<sub>2</sub> ~85-95
  - Avoid N<sub>2</sub>O
- **Emergence**
  - Aim for a quick emergence with recovery of airway reflexes
  - Dexamethasone for post-instrumentation edema
  - Can intubate (post FB removal with rigid bronchoscope) to minimize risk of aspiration while airway reflexes return

#### DISPOSITION & MONITORING

- Patients may have worsening respiratory function secondary to airway edema or infection
- First 24 hours is the most important re: laryngeal edema
- Consider aggressive use of humidified oxygen, racemic epinephrine, steroids, antibiotics
- Some patients may require post-op ventilation
- Physiotherapy is indicated to mobilize consolidation (if present)

#### COMPLICATIONS

- Bronchospasm – relatively common, especially with lavage

- Treat aggressively with ventolin
- Deepen anesthetic
- IV steroids may be useful
- Inadequate ventilation
  - Reposition bronchoscope into proximal airway
  - Ensure adequate seal
  - Consider pneumothorax
- Unable to ventilate / complete airway obstruction
  - Consider pneumothorax, bronchospasm
  - Immediate removal of laryngeal FB
  - Have surgeon push tracheal FB into mainstem w/ scope
  - Thoracotomy / bronchotomy
- Hypertension, tachycardia or arrhythmias
- Pneumothorax / barotrauma / BPF – relatively rare
- Tracheobronchial trauma / pulmonary hemorrhage
  - Sharp object vs. inflammatory
  - Rigid bronchoscope
- Pneumonia

#### PATHOPHYSIOLOGY

- 300 deaths / year in US
- Most common in the pediatric population, especially at ages 1-3 years old
- The goal is to **remove aspirated foreign bodies within 24 hours**
- Presentation
  - Acute life-threatening
  - More commonly delayed presentation
  - In chronic cases, foreign body aspiration is often misdiagnosed as a URTI, asthma, or pneumonia (1-2 weeks of unexplained cough / wheeze / dysphagia)
  - Chronic cases often result in post-obstruction atelectasis, and possibly pneumonia
- Nature of FB
  - Food-items: carrots, nuts, candies, grapes, seeds, and egg shells
  - Nonfood-items: balloons, coins, tops from beverage cans, pills, safety pins, ball bearings, marbles, and baby powder
  - Most common tracheobronchial foreign bodies are peanuts
  - Most common fatal aspiration is latex balloon
  - Vegetable matter → swells / obstructs
  - Nuts (oils) → inflammatory response
  - Sharp → perforates
- Location
  - A foreign body may become lodged at any point in airway, but if it travels distally, it is most likely in the right side of the tracheobronchial tree
  - **Two thirds lodge in the mainstem bronchi, remainder are found in the distal bronchi**
  - **Esophageal foreign bodies at the level of the cricopharynx may cause respiratory effects**
    - If large, they may cause respiratory arrest; otherwise, they may cause inflammation and subsequent compression of the airway
- Effect
  - Vegetable items expand with moisture and fragment
  - Nuts release oils which cause chemical inflammation
  - Sharp objects may cause bleeding
- **Rigid bronchoscopy**
  - Rigid bronchoscopes are numbered based upon **internal diameter (2.5-10mm)** and range in length from **25-40cm**
  - Side arm adapter for application of ventilation
  - Ventilation is controlled and provided manually, though jet ventilation is possible
  - For critical airway stenoses (< 5 mm in adults) spontaneous ventilation should be maintained until bronchoscope dilates or is distal to obstruction
  - It is best suited for acute relief of central airway obstruction
  - **Indications**
    - massive hemoptysis, foreign body removal, control of airway stenoses, removal of obstructing neoplasms, placement of airway stents, endobronchial laser therapy, pediatric bronchoscopy, large biopsies & rapid removal of airway debris
  - **Contraindication:** significant cervical spine lesion
  - Because of its rigid, linear design, it is limited to pathology at or above segmental bronchi → the major complication is subglottic edema

#### REFERENCES

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